



TITLE:

Effect of molecular packing efficiency on the epitaxial growth modes of monomolecular film on graphite studied by STM/ Lattice defects in organic crystals revealed by direct molecular imaging (STATES AND STRUCTURES - Electron Microscopy and Crystal Chemistry)

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States and Structures -Electron Microscopy and Crystal Chemistry-



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Visitors

Prof BEKALOGLU Ozer	Technical University of Istanbul, Turkey, 19-21 January 2001
Prof TORRES Thomas	The Autonoma University of Madrid, Spain, 2-3 February 2001
Prof FUCHS Harald	University of Münster, Germany, 4-5 September 2001
Prof ULANSKI Jacek Pawel	Technical University of Lodz, Poland, 19-20 September 2001

Scope of Research

Structures of materials and their structural transition associated with chemical reactions are studied through direct observation of atomic or molecular imaging by high-resolution spectromicroscopic method which realizes high resolution energy-filtered imaging as well as electron energy-loss spectroscopy. It aims to explore new methods for imaging and also obtaining chemical information in thin films, nano-clusters, interfaces, and even in solutions. By combining with scanning probe microscopic methods, the following subjects are studied: direct structure analysis, electron crystallographic analysis, epitaxial growth of molecules, structure formation in solutions, fabrication of low-dimensional functional assemblies.

Research Activities (Year 2001)

Presentations

Correlation between dynamical effect and real thickness of crystal in electron diffraction intensity, Kuwamoto K, Annual Meeting Elec. Micro., 11 May.

Electron radiation damage processes in TCNQ and F₄TCNQ studied with an imaging plate, Hasegawa H, Annual Meeting Elec. Micro., 11 May.

Electron radiation damage processes in TCNQ and F₄TCNQ studied by EELS, Koshino M, Annual Meeting Elec. Micro., 12 May.

STM study on photopolymerization of 17, 19-hexatriacontadiyne monomolecular layer, Irie S, 13th Intern. Conf. on Crystal Growth, 31 July.

Lattice-lattice interaction in pseudo-commensurate epitaxy at liquid/solid interfaces, Isoda S, 15th Intern. Conf. on Chem. of the Organic Solid State, 1 Aug.,

Formation process of ultrafine platinum particles in an

aqueous solution with a surfactant, Hahakura S, 13th Intern. Conf. on Crystal Growth, 2 Aug.

Comparative study on surface morphology by photo- and thermal-polymerization of a diacetylene, Yaji T, 4th Intern. Conf. Non-contact AFM, 2 September.

Bulk, surface and interface polymerized in solid-state, Isoda S, Summer Seminar of Fiber Soc. Jpn., 6 September.

Organic epitaxy mode and two-dimensional packing efficiency, Fujiwara E, Autumn Meeting, Chem. Soc. Jpn., 22 September.

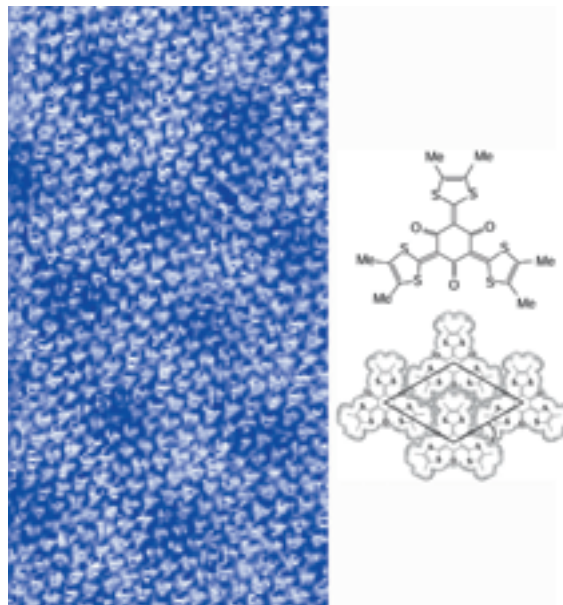
Epitaxial growth of (μ-oxo)bis(phthalocyaninato)aluminium(III), Suga T, Autumn Meeting, Chem. Soc. Jpn., 22 September.

Local charge transfer in iron-phthalocyanine-amine complexes, Isoda S, Meeting, Coordination Chemistry, 28 September.

Topics

Effect of molecular packing efficiency on the epitaxial growth modes of monomolecular film on graphite studied by STM

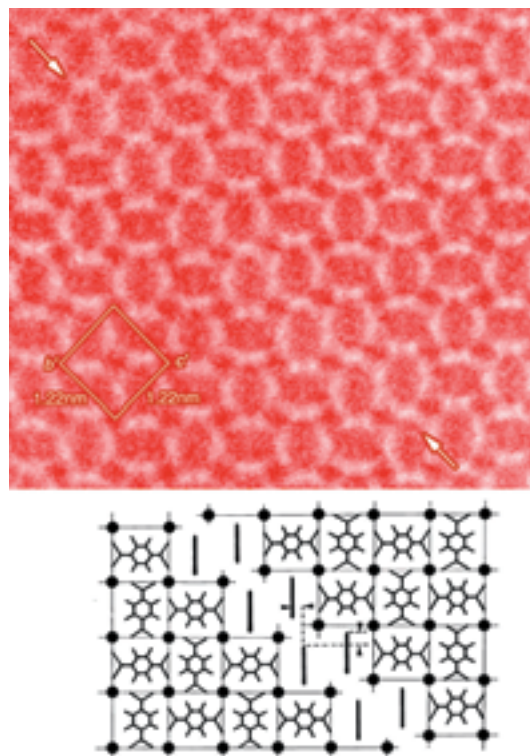
The monomolecular film of a triangular molecule vacuum-deposited on a (0001) surface of graphite was observed by scanning tunneling microscopy, in order to examine its growth mode and structure. The flat lying molecules form an ordered close-pack arrangement in the film on graphite as shown in the figure. The unit lattice of the monomolecular layer was found to be incommensurate to the substrate lattice, judging from two-dimensional moire-like contrast modulation. This result is compared with other cases of molecules reported already from a viewpoint of two-dimensional packing that indicates the intermolecular interaction in monomolecular layer [1]. The packing efficiency, a newly proposed parameter, in the monomolecular layer is concluded to characterize the growth modes of monomolecular layer formed on substrates; commensurate, point-on-line and incommensurate.



1. Fujiwara E, Isoda S, Ogawa T, Kobayashi T and Yamashita Y, *Surf. Sci.*, **487**, 118 (2001).

Lattice defects in organic crystals revealed by direct molecular imaging

The arrangement of molecules at crystal defects in organic crystals was examined with a high-resolution electron microscope [2], and the results are discussed from molecular interaction around the faults. The stacking fault in a charge transfer complex of $K^+TCNQF_4^-$ is interpreted to be a defect produced by the deficiency of one molecular plane along the (001) or (010) plane as shown by the arrows in the figure shown below. The expected molecular packing near the stacking fault is shown schematically in the figure. An edge dislocation found in a quaterrylene thin crystal is made by two excess half-planes along the a -axis without forming stacking faults. At the core of the dislocation, some unpaired molecules are located to fill the space produced by the edge dislocation, although the molecules in the perfect crystal are packed in the sandwich herringbone-type arrangement (paired molecules)



2. Maeda T, Kobayashi T, Nemoto T and Isoda S, *Phil. Mag.*, **81**, 1659 (2001).